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1933

## Mechanics and Electricity (1st Year): Technical School Examinations 1933

Department of Education: Technical Instruction Branch

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### Recommended Citation

Department of Education: Technical Instruction Branch, "Mechanics and Electricity (1st Year): Technical School Examinations 1933" (1933). *Technical Schools:Examination Papers*. 10.  
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# COURSE IN MOTOR CAR ENGINEERING.

(70.)

AN ROINN OIDEACHAIS.

(Department of Education.)

BRAINSE AN CHEÁRD-OIDEACHAIS.

(Technical Instruction Branch.)

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TECHNICAL SCHOOL EXAMINATIONS.

1933.

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MECHANICS AND ELECTRICITY.

(First Year.)

*Monday, May 8th—7 p.m. to 10 p.m.*

*Examiner—M. KEADY, ESQ., B.SC. (Eng.), A.R.C.SC.I.*

*Co-Examiner—J. P. HACKETT, ESQ., B.E., A.R.C.SC.I.*

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## GENERAL INSTRUCTIONS.

You are carefully to enter on the Answer Book and Envelope supplied your Examination Number and the subject of examination, but you are not to write your name on either. No credit will be given for any Answer Book upon which your name is written, or upon which your Examination Number is not written.

You must not have with you any book, notes, or scribbling paper.

You are not allowed to write or make any marks upon your paper of questions.

You must not, under any circumstances whatever, speak to or communicate with another candidate; and no explanation of the subject of the examination may be asked for or given.

You must remain seated until your answer book has been taken up, and then leave the examination room quietly. You will not be permitted to leave before the expiration of twenty minutes from the commencement of the examination, and will not be re-admitted after having once left the room.

If you break any of these rules, or use any unfair means you are liable to be dismissed from the examination, and your examination may be cancelled by the Department.

*Three hours are allowed for this paper. Answer books, unless previously given up, will be collected at 10 p.m.*



## INSTRUCTIONS.

*Read the General Instructions on page 1.*

(a) The working of the questions and the answers must be in *ink*.

(b) Diagrams and drawings must be made in *pencil*.

(c) Full credit cannot be obtained for any questions unless all the calculations are shown clearly, and construction-lines definitely indicated.

Where calculations are made with the aid of the slide-rule a note should be made in the margin, thus—(S.R.).

(d) Equal values are assigned to the questions.

(e) Write the number of the question before the answer.

NOTE.—You are expected to make neat and correct diagrams. You may use a slide-rule and drawing instruments.

## SECTION A.

*(Not more than three questions may be attempted from this Section.)*

1. Given that 1 yard = 39.37 inches prove that 1 kilometre is approximately five-eighths of 1 mile.

2. Using the relationship between kilometres and miles given in question 1, draw a graph connecting speeds expressed in miles per hour with speeds expressed in kilometres per hour for speeds up to 60 m.p.h. Use the graph to convert a speed of 38 m.p.h. to kilometres per hour, and a speed of 87 kilometres per hour to miles per hour.

3. Neglecting overlap for seams, calculate the area of sheet metal required for the construction of a cylindrical tank 8 inches inside diameter and closed at both ends, to hold 2 gallons.

( $6\frac{1}{4}$  gallons = 1 cubic foot.)

4. A car is towed by means of a rope which is inclined upwards at an angle of  $20^\circ$  to the horizontal. If the pull in the rope is 120 lbs. weight find (a) the horizontal force tending to urge the car forward, (b) the vertical force tending to lift it.

5. Explain what is meant by the term "work" as used in mechanics.

Calculate the work done in bringing a car weighing 30 cwt. a distance of 300 yards up an incline of 1 in 30. (Neglect road and wind friction).

6. The distance between the front and rear axles of a car is 7' 6". Calculate the load on each wheel due to a load of 8 cwt. placed in the car at a distance of 2' 6" in front of the rear axle.

7. A spiral spring is stretched by gradually increasing loads. Describe how the extension of the spring varies with the load, and hence, show how the spring may be used as a "force measurer."

## SECTION B.

*(Not more than three questions may be attempted from this Section.)*

8. Describe, with the aid of sketches, simple experiments which illustrate the heating, magnetic and chemical effects of the electric current.

Mention one practical application of each effect.

9. The two magnetising coils for a horseshoe electro-magnet which is to have one N and one S pole are wound on separate bobbins and then placed on the legs of the electromagnet.

Show by a diagram the direction of the winding on each leg and the way in which the coils are connected together—indicating the direction of the current and the resulting polarity.

Describe how the strength of the electromagnet varies as the current in the windings is increased.

10. The resistance of a piece of wire is 4 ohms. what is the resistance of another piece of the same material which is three times as long and which has twice the cross-sectional area?

What current will flow if these wires are connected (a) in series, (b) in parallel across a 12 volt battery of negligible internal resistance.